

Special Systematic Reviews 2009  
Current Status of Liver Diseases in Korea:  
Report from the Epidemiology Study Group of the KASL

## Current status of hepatic surgery in Korea

Kyung Sik Kim

*Department of Surgery, Severance Hospital,  
Yonsei University College of Medicine, Seoul, Korea*

### = Abstract =

Since the first liver resection was carried out in Korea in 1959, there have been remarkable changes in the field of surgery. With technical advancement and the improvement of perioperative care, liver resections are widely performed and surgical mortality is approaching zero. In the early 1990s, liver transplantation evolved as a feasible option in the treatment of end-stage liver disease in Korea, with successful adult living-donor liver transplantation (LDLT) as one of the greatest achievements. Various innovations in surgical approaches have been introduced. We review the current status of hepatic surgery in liver disease in Korea.

**Key words:** Hepatectomy, Liver transplantation, Portal shunt

**Abbreviations:** LC, liver cirrhosis; HBV, hepatitis B; HCV, hepatitis C; PBC, primary biliary cirrhosis; AIH, autoimmune hepatitis; HCC, hepatocellular carcinoma; CCC, cholangiocarcinoma; ICG, Indocyanine green; LDLT, living-donor liver transplantation; CDLT, cadaveric whole liver transplantation; DDLT, deceased-donor liver transplant; ACLF, acute on chronic liver failure; SBC, secondary biliary cirrhosis; PCLD, polycystic liver disease; BD, bile duct

---

Received November 30, 2009; revised December 22, 2009; accepted December 22, 2009

Corresponding author: Kyung Sik Kim, M.D.  
Department of Surgery, Yonsei University College of Medicine  
250, Seongsanno, Seodaemun-gu, Seoul 120-752, Korea  
Tel: +82-2-2228-2125 Fax: +82-2-313-8289 E-mail: kskim88@yuhs.ac

\* Dr Kim has no potential conflict of interest to report for this article.

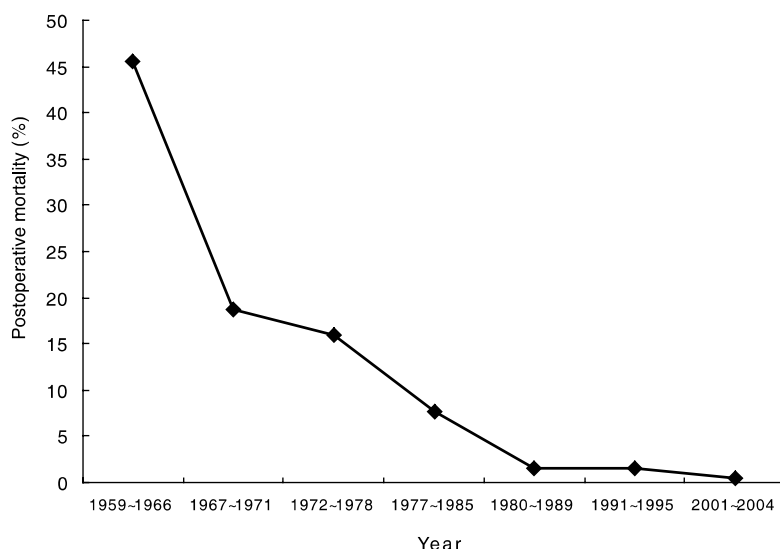
The first liver resection was carried out in Korea in 1959. A right hepatectomy was performed on a 52-year-old woman who had cholangiocarcinoma, but she died of bile peritonitis on the 9<sup>th</sup> postoperative day.<sup>1</sup>

Following that first liver resection, various procedures were carried out during the 1960s and 1970s for both malignant and benign conditions. According to reports on 189 cases and the number of liver resections performed in several major hospitals from 1959~1978,<sup>2</sup> the operations were not frequently performed during that period, and, unfortunately, nationwide statistical data was not collected. Perioperative mortality was 45.5% 1959~1966, and 16% 1972~1978.

From 1980 to 1990, liver resection was more widely practiced and mortality decreased (7.6%, 1977~1985).<sup>3</sup> During this period, many surgeons gradually began to consider residual liver function as an important prognostic factor. Various examinations for the evaluation of liver residual functions – ICG (indocyanine green) R15, ICG Rmax, oral GTT (oral glucose tolerance test), RTI (redox tolerance index) and AKBR (ketone body ratio) - were introduced, but there was no gold standard for estimating liver function. Combining several methods was inevitable, and the Child-Pugh score and ICG tests became the most popular in Korea. In the mid-1980s, the Cavitron Ultrasonic Surgical Aspirator for liver parenchymal dissection was introduced.<sup>4</sup>

During the period 1990~2000, preoperative portal vein embolization in preparation for massive liver resection was introduced.<sup>5,6</sup> Liver resection for various benign conditions like benign tumors and intrahepatic bile duct stone diseases were also the main issues in the field of liver surgery. During this same period, liver transplantation caused an upsurge in the number of studies on donor hepatectomy.<sup>7</sup> Liver resection is still considered the gold standard method of treatment for hepatocellular carcinoma (HCC), although some local ablative therapies show good outcomes as well that are comparable to results after surgery. Since 1990, the outcomes of liver resection have improved. Perioperative mortality and morbidity has markedly decreased (morbidity 10%, mortality 1~2%)(Fig. 1).<sup>8,9</sup>

Surgery for variceal bleeding has undergone remarkable changes. Originally, various shunt operations were used for variceal bleeding, which is a major complication of portal hypertension. In the 1960s, most surgeons knew of the benefits of the selective shunt, especially the distal splenorenal shunt (Warren shunt).<sup>10</sup> In the

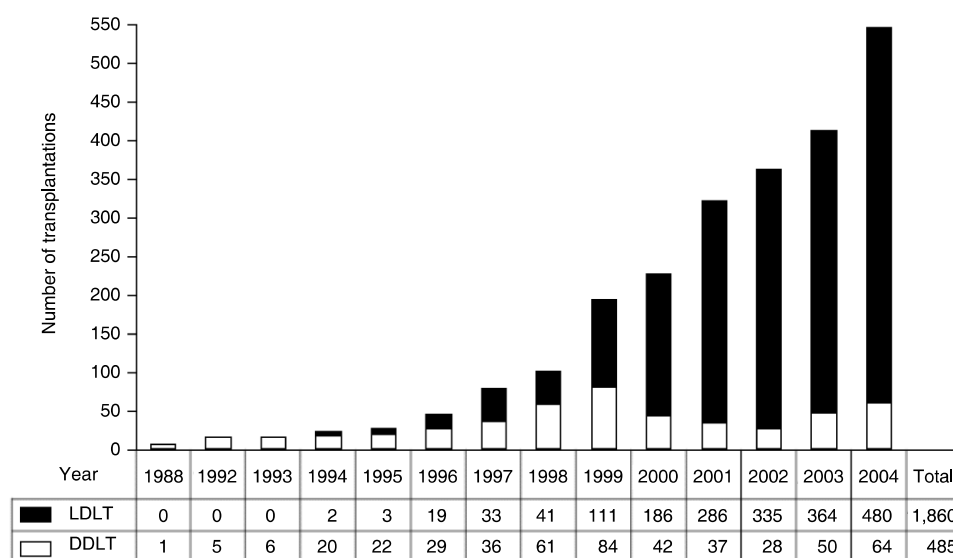


**Figure 1.** The change in postoperative mortality rate after liver resection in Korea

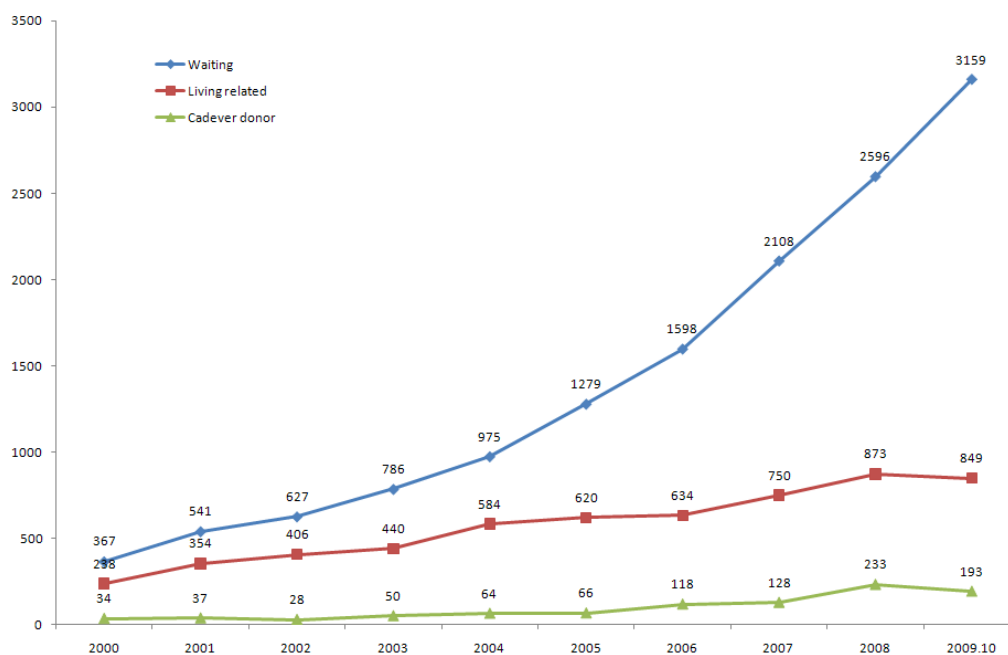
1970s, several variceal ablative procedures such as the Sugiura operation and the terminal esophago-proximal gastrectomy were introduced, but shunt operations were still the mainstay. In 1980, variceal ablative procedures were used in the majority of cases (91.6%). The Sugiura operation was one of the most popular procedures, but several variations including the Kobayashi operation and the Hassab operation were frequently used as well.<sup>11</sup> Contrary to the trend in the West, non-shunt operations were preferred in Korea as they were in other Asian countries. As endoscopic procedures such as endoscopic injection sclerotherapy, endoscopic band ligation, and interventional methods like transjugular intrahepatic portosystemic shunt (TIPS) were developed, the use of surgical procedures for portal hypertension decreased.<sup>12-13</sup>

In Korea, the first liver transplantation was carried out in 1988 on a 13-year old Wilson's disease patient using the orthotopic whole organ cadaveric donor liver transplantation (CDLT) method.<sup>14</sup> In 1994, a living donor liver transplantation (LDLT) was carried out on a 6-month-old patient with biliary atresia for the first time in Korea.<sup>7</sup> The first Korean LDLT on an adult was performed in 1997.<sup>7</sup> Since 1997, the number of liver transplantations in Korea has grown remarkably on an annual basis. From 1988 to 2004, 2,345 liver transplantations (LDLT in 1,860 cases: 79.3%, CDLT in 485 cases: 20.7%) were carried out in Korea (Fig. 2).<sup>15</sup>

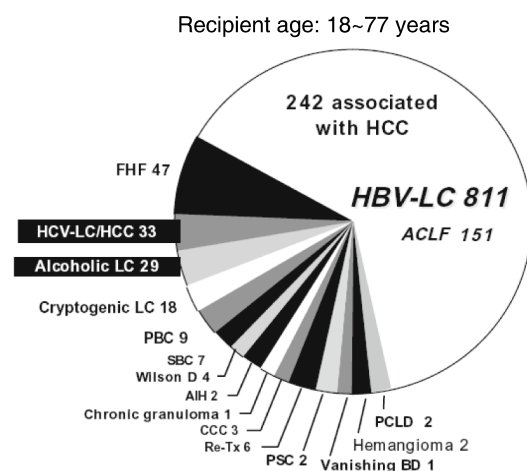
As transplantations grew in number, many new challenges became evident, such as the reconstruction of the middle hepatic vein tributaries in right lobe LDLT to avoid anterior segment congestion, dual two-left-lobe graft LDLT to overcome graft-size insufficiency, and donor risk.<sup>7</sup> In terms of prognosis after liver transplantation, in 1998, the 1-year graft survival rate after LDLT and CDLT in Korea was 80% and 62% respectively, but in 2004, it improved to 83% and 76% respectively.<sup>15</sup> According to a report from 4 transplantation centers in Korea on liver transplantation for HCC, the perioperative mortality rate after liver transplantation on HCC patients was 18.7% for the CDLT group and 10.1% for the LDLT group, and the 3-year survival rate was 61.1%



**Figure 2.** Trends in liver transplantations in Korea. LDLT, living-donor liver transplant; DDLT, deceased-donor liver transplant (Excerpted from 'Lee SG. Current status of liver transplantation in Korea. Korean J Gastroenterol 2005;46:75-83.').



**Figure 3.** The number of patients waiting for liver transplantation, in comparison with the number of living related and cadaveric donor liver transplantations performed.



**Figure 4.** The graph of 1,000 adults (age >18 years) with living donor liver transplantations performed between February 1997 and January 2006 (Excerpted from 'Lee SG. Towards 300 liver transplants a year. Surg Today 2009;39:367-373'). LC, liver cirrhosis; HBV, hepatitis B; HCV, hepatitis C; PBC, primary biliary cirrhosis; AIH, autoimmune hepatitis; HCC, hepatocellular carcinoma; CCC, cholangiocarcinoma; ACLF, acute on chronic liver failure; SBC, secondary biliary cirrhosis; PCLD, polycystic liver disease.

for the CDLT group and 73.2% for the LDLT group.<sup>16</sup> In 2007, in-hospital mortality fell to 5%, and since then, the liver transplantation donor mortality has not been reported.<sup>7</sup>

The shortage of donors is a serious problem in Korea (Fig. 3). The law for organ transplantation and brain death was framed in Korea in 1999, and the Korean Network for Organ Sharing (KONOS) was organized. Despite these improvements, the annually reported brain death rate is 3.15 cases per 1,000,000 people, which is a very small number compared to the 10~33 cases reported in the West.<sup>17</sup> Split liver transplantation provides an ideal means to expand the donor pool for both children and adults.<sup>7,18</sup> Because of the limited number of donors, LDLT has inevitably been promoted. Indications for liver transplantation in Korea include liver cirrhosis

(LC) caused by the Hepatitis B virus (HBV), which is the most common, followed by HCC, acute fulminant hepatitis, and LC induced by alcohol (Fig. 4).<sup>7</sup>

## References

1. Chang KR. Practice of massive hepatic resection in Korea. *Korean J Gastroenterol* 1968;1:16-20.
2. Kang HJ, Park YH, Chang KR. Massive hepatic resection in Korea. *J Korean Surg Soc* 1980;22:273-287.
3. Seong MK, Kim ST. Clinical experiences of hepatic resection. *J Korean Surg Soc* 1986;30:284-296.
4. Kim HJ. Liver Resection utilizing the ultrasonic surgical aspirator. *J Korean Surg Soc* 1987;32:9-16.
5. Choi KM, Lee SG, Min PC, Sung GB. Preoperative PVE(portal vein embolization) for preparing massive liver resection. *J Korean Surg Soc* 1995;48:69-76.
6. Hwang S, Lee SG, Lee YJ, Park KM, Jeon HB, Sung GB, et al. Significance of preoperative portal vein embolization of cirrhotic livers for major hepatectomy. *J Korean Surg Soc* 1997;53:560-570.
7. Lee SG, Hwang S, Kim KH, Ahn CS, Moon DB, Ha TY, et al. Toward 300 liver transplants a year. *Surg Today* 2009;39:367-373.
8. Lee KU, Koh YT, Kim JJ, Kim KH, Cho BS, Suh KS, et al. Prognostic factors of hepatocellular carcinoma after curative hepatic resection. *Korean J Hepatobiliary Pancreat Surg* 1997;1:41-58.
9. Seo HI, Park SJ, Kim SH, Lee WJ, Ahn M, Park HS, et al. Prognostic factor analysis of 200 consecutive hepatic resections for hepatocellular carcinoma. *Korean J Hepatobiliary Pancreat Surg* 2006;10:21-28.
10. Chae YM, Kim HB, Lee CY, Rah DH. Clinical observation of surgical treatment for the bleeding esophageal varices with portal hypertension. *J Korean Surg Soc* 1980;22:429-437.
11. Kim SM, Kim YC, Hyun JH. Management of esophageal varix bleeding. *J Korean Surg Soc* 1992;42:755-769.
12. Chung JB, Nam DK, Han KH, Kim WH, Kim DY, Chon CY, et al. Endoscopic injection sclerotherapy in patients with bleeding esophageal varices: a retrospective analysis. *Korean J Intern Med* 1990;5:5-14.
13. Yoon CJ, Chung JW, Park JH. transjugular intrahepatic portosystemic shunt for acute variceal bleeding in patients with viral liver cirrhosis: predictors of early mortality. *AJR Am J Roentgenol* 2005;185:885-889.
14. Kim ST, Park YH, Lee KU, Yoon YK, Kim SW, Yang HK, et al. An experience of liver transplantation in Korea. *J Korean Soc Transplant* 1988;2:27-36.
15. Lee SG. Current status of liver transplantation in Korea. *Korean J Gastroenterol* 2005;46:75-83.
16. Hwang S, Lee SG, Joh JW, Suh KS, Kim DG. Liver transplantation for adult patients with hepatocellular carcinoma in Korea: comparison between cadaveric donor and living donor liver transplantations. *Liver Transpl* 2005;11:1265-1272.
17. Kim MS, Kim SI, Kim YS. Current status of deceased donor organ recovery and sharing in Korea. *J Korean Med Assoc* 2008;51:685-691.
18. Suh KS, Lee KW, Koh YT, Roh HR, Chung JK, Minn KW, et al. First successful in situ split-liver transplantation in Korea. *Transplant Proc* 2000;32:2140.